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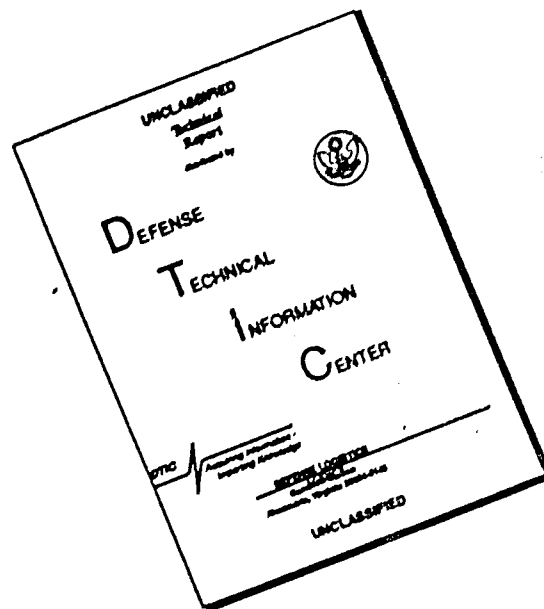
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DEPARTMENT OF THE ARMY
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WASHINGTON, D.C. 20310

IN REPLY REFER TO

AGAM-P (M) (20 Jun 67) FOR OT

28 June 1967

SUBJECT: Operational Report - Lessons Learned, Headquarters, 19th
Engineer Battalion (Combat)

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Headquarters, 19th Engineer Battalion (Combat) for quarterly period
ending 31 January 1967. Information contained in this report should be
reviewed and evaluated by CDC in accordance with paragraph 6f of AR 1-19
and by CONARC in accordance with paragraph 6c and d of AR 1-19. Evalu-
ations and corrective actions should be reported to ACSFOR OT within 90
days of receipt of covering letter.

2. Information contained in this report is provided to the Com-
mandants of the Service Schools to insure appropriate benefits in the
future from lessons learned during current operations, and may be
adapted for use in developing training material.

BY ORDER OF THE SECRETARY OF THE ARMY:

Kenneth G. Wickham

KENNETH G. WICKHAM
Major General, USA
The Adjutant General

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DEPARTMENT OF THE ARMY
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31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

THRU: Commanding Officer
45th Engineer Group (Const)
APO 96238

Commanding General
18th Engineer Brigade
APO 96377

Commanding General
United States Army Engineer Command, Vietnam
APO 96491

Commanding General
United States Army, Vietnam
ATTN: AVC-DH
APO 96307

Commander in Chief
United States Army, Pacific
ATTN: GPOP-MH
APO 96558

TO: Assistant Chief of Staff for Force Development
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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967.

2

Section 1. Significant Organization or Unit Activities

1. Narrative Summary of Activities.

a. During the quarter November 1966 through January 1967, the 19th Engineer Battalion's role and main mission changed from combat support to construction. The combat support operations Thayer, Tiger Hound, and MANG HO 8 were terminated and the battalion undertook construction projects in support of the development of the Qui Nhon area. This transition, while deliberate and smoothly conducted, required readjustment from operational support to construction operations. Long range planning replaced expediency, scheduling replaced on-hand capability, and a constant job effort was necessary rather than the hasty short term mission requirement of combat support roles.

b. On 10 November 1966, the battalion was reassigned from the 937th Engineer Group (Combat), to the 45th Engineer Group (Const). The 937th Engineer Group was relocated to Pleiku, while the 45th Engineer Group moved to Qui Nhon from Dong Ba Thin. The change of Groups resulted in a realignment of Engineer Areas of Responsibility, a reassignment of projects among Engineer Battalions within the groups, and readjustment of reports, procedures, and directives. Through coordination with all units concerned, diligent planning, review and analysis of transferred projects and combat support missions, the transition was smoothly executed.

c. During this Quarter, elements of the battalion spent 108 days in rear area construction, 85 days in combat support operations, and 15 days training.

2. Significant Functional Activities:

a. Personnel, Administration and Organization

The battalion headquarters remained in the Qui Nhon area throughout the entire reporting period and provided a base for resupply of personnel and material, a coordination center, and a command post. This proved to be an especially helpful asset in the resupply of personnel. New men could then be oriented in the functional requirements of the battalion, their individual roles explained, plus achieve group identification, all in secure surroundings. An average of 45 replacements a month were received into the battalion for the quarter. This figure is in contrast to the 49 men lost per month to rotation. The present battalion strength including attached units is:

<u>Unit</u>	<u>Authorized</u>	<u>Assigned</u>	<u>Percent</u>	<u>Present for Duty</u>
19th Engr Bn	619	596	95%	529
554th Engr Co (-)	162	155	96%	151
509th Engr Co (-)	43	41	95%	38

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

3. The significant change in the battalion personnel status was the reassignment of the 509th Engineer Company (PB) and the 2nd and 5th platoons of the 554th Engineer Company (FB) to the 937th Engineer Group located at Pleiku on 3 December 1966. The 1st platoon of the 509th Engineer Company remained with the 19th Engineer Battalion for Panel Bridge support and was attached to the 554th Engineer Company (FB). The transfer of the 2nd and 5th platoons of the 554th ~~Pleiku~~ Bridge Company required that one half of both the maintenance section and LTR support platoon be relocated to Pleiku, leaving the 1st, 3rd, and 4th platoons, with the other half of the support maintenance and LTR sections.

With the loss of the 509th Panel Bridge Company, the need for the "D" Company authorized by TO & E 5-35E became more apparent. The battalion continues to emphasize to higher headquarters the importance of conversion to and operation under TO & E 5-35E as this conversion would increase the battalion's capability to perform its mission.

A dual program to minimize piaster expenditures and increase the morale has been implemented and expanded during this quarter. Battalion recreational facilities have been constructed to include several basketball courts, badmitten and volley ball courts, horseshoe areas, and improved softball-parade field. Both the NCO and EM Clubs have been continuously helpful in this effort by providing a comfortable social atmosphere and place for live entertainment. Dayroom furnishings and equipment such as televisions, tape recorders, record players, writing tables, assorted games and athletic equipment have been provided through the self-service store, unit funds, and self-help construction programs.

Installation and operation of 150KW generator providing central power for the battalion complex has contributed to the welfare of the troops by providing dependable and increased power for lighting, televisions, refrigerators and other electronic conveniences. A new hot running water shower was completed and put into service in December. With a hot water capacity of approximately 2,000 gallons, all personnel assigned and attached to the battalion can enjoy a hot shower each day. During the monsoon season and advent of cold weather, the hot shower helped maintain the high morale and spirit of the battalion.

The savings programs, soldiers deposits, and US Savings Bonds have obtained and maintained a 98% battalion participation during the quarter, which reflects the effectiveness and success of the battalion efforts to reduce piaster expenditures in the local economy and gold outflow in the US balance of payment.

A battalion tire changing shop has been incorporated into the new maintenance building. Employing five local laborers, all flat tires are turned in for direct exchange of a newly mounted tire. Instant success of the program resulted in a similar system incorporated into the motor pool of the 554th Engineer Company (FB). Such a program keeps all drivers out of the local Vietnamese tire changing shops, reduces piaster expenditures, and is hoped to reduce the units venereal disease rate.

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

4

The combination community center/chapel has been approved; however, due to non-essential construction directive, construction has been postponed until self-help construction programs of the adjacent units are comparable to the battalion's compound. Services are still conducted in the EN Club. Attendance has remained high throughout the quarter.

The self-help construction program of the battalion was completed this quarter with the construction of a three bay 50' x 60' maintenance building. The company area previously occupied by the 509th Engineer Company (PB) is presently reserved for the expected "D" Company addition to the battalion. All buildings are locked and periodically checked for maintenance requirements.

The implementation of self-help program for the 554th Engineer Company (Float Bridge) has further increased the morale of the Company. A hot water shower and latrine have been completed. 28 January 1967 noted the official opening of the units mess hall, which will be followed closely by a maintenance area and troop billets.

The reporting period saw some marked improvements in the medical service facilities of the battalion. The battalion dispensary, previously a tropical building, was boarded up and air conditioning installed to reduce the dust and noise which had hindered their activities. All patients who had previously been affected with VD were referred to the 85th Evacuation Hospital for a blood test. This is a departure from the old method of treating patients and discharging them after the initial blood test. A dentist and assistant was added to the medical staff. During the period the sick call rate averaged 540 per month. The dental visit rate was 130 per month since 1 December 1966. With the acquisition of more instruments, the dentist is expected to care for an increased number of patients. At the dispensary, a suspense card filing system was initiated which assured personnel of timely and necessary shots and immunizations. A centralized SOP plan was prepared for securing proper health examinations for food handlers. The incident of VD was investigated and several proposals were made and are being studied for possible implementation.

b. Operations and Training

The relocation of the 937th Engineer Group (Combat) to Pleiku, and corresponding reassignment of the 19th Engineer Battalion to the 45th Engineer Group (Const) provided the basis for project transfer and the redesignation of Engineer Area of Responsibility (See Appendix 4 & 5). Completion of both the initial and advance phases of combat operations to reopen all national highways significantly reduced the combat support commitment of the battalion. Consequently the battalion's construction and operational support mission assignments were changed.

(1) The following projects were transferred from the battalion on
27 November 1966:

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

(a) Maintenance of Route 19, required repair of potholes and road for a 40 mile stretch from Qui Nhon to the An Khe Pass. 38,610 US Manhours, 5,232 Vietnamese manhours and 5,693 equipment hours had been expended to bring project to 59% complete.

(b) The Cha Rang Maintenance Complex located on Route 19 in the Qui Nhon area was transferred as being 79% complete. Since start of project in February 1966, 89,900 US manhours, 160,580 Vietnamese hours, and 11,900 equipment hours had been expended. Scope of work accomplished included the clearing of 54.9 acres of land, drainage system installed with 28 culverts and headwalls, 1.9 miles of internal access roads constructed. Vertical construction completed using prefabricated steel buildings included 15,400 square feet of administration buildings, 3,000 square feet of dispensary, 27,800 square feet of maintenance buildings, 19,600 square feet of covered storage and 60% completion of 17,800 square feet of maintenance buildings. Facilities had been in use since November by the 618th Direct Support Maintenance Company providing immediate utilization of the maintenance complex.

(c) The 1700 man cantonment area located on Route 19 vicinity of Qui Nhon was transferred as being 55% complete. Project includes 26,910 US manhours, 32,000 Vietnamese manhours and 4,711 equipment hours to accomplish the clearing of 40 acres of land, with 1.4 miles of internal access roads, five 20' x 120' mess halls and twelve 20' x 60' community facilities buildings.

(d) The Qui Nhon to An Khe Pipeline at 61% complete was started in August 1966 and transferred with 31,950 US manhours, 7,790 Vietnamese manhours and 12,271 equipment hours expended by this battalion and the 1st platoon, 697th Engineer Company (Pipeline Construction). Work accomplished at time of transfer was 50.6 miles of 6" pipe laid and coupled, two pump stations were completed with piping plus an area cleared for a third pump station. The pipeline had been laid completely in this unit's engineer area of responsibility except for six gaps, three pump stations and three suspension bridges that remained to be constructed. In addition to the project transfer, the 1st platoon of the 697th Engineer Company was reassigned from the battalion in order to complete the project.

(e) Route 1 Road Construction Project, from Route 440 to the Ammo Supply Depot: Project was started on 10 July 1966 and prior to transfer, one class 35 steel stringer bridge 57' long with intermediate pile bent support, one by-pass with three 48" and one 60" culverts, and extensive repair of 3" minus rock surface placed on 5.3 miles of road was completed. During construction road remained open for traffic at all times.

(2) The following new projects were assigned to the battalion:

(a) The Logistical Depot Expansion Project: The Depot area, located at Long My covers approximately 60 acres of land, will include 21,350 square yards of roads, 312,000 square yards of open storage area, 863,700 square

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

feet of covered storage and 6,765 linear feet of culvert to drain 39,900 linear feet of ditches. The areas of the project scheduled to be open storage areas are being used by the depot immediately upon completion of the clearing and grubbing of the land. Construction was initiated by the 554th Float Bridge and "A" Company but reassigned to "B" Company in December. Emphasis this quarter has been placed on completion of the topography, layout of the area, plus clearing, grubbing and stripping of the land. Access and interior roads to include drainage have been initiated, and with the end of the monsoon season in January, progress on the project has increased sharply. Commencement of a double shift after the rainy season has been the primary reason for rapid progress on the project. The double shift commences at 1200 hours and ends at 1200 hours, when the second shift starts and operates until 2200 hours. Since the majority of work required at the site was equipment effort, the double shift has utilized the equipment to the maximum extent. Maintenance is performed during and after each shift keeping the deadline rate to a minimum.

(b) The Phu Tai Ammo Dump: At this site, general maintenance was required of the supply point due to damage caused by flash flooding during the monsoon season. Repairs were made by "C" Company which required installation of culverts, grading and shaping of road, and cutting of new drainage ditches. The project was temporarily postponed upon commencement of priority CH 47 Helicopter project.

(c) Road Base Course: In January the battalion was also assigned road preparation and bridge construction in anticipation of the asphalt road surfacing program scheduled in the Qui Nhon area. "A" Company presently is building a class 60 bridge, 50' single span bridge for the access road to the 45th Engineer Group Construction Support Complex, and a 35' single span bridge on Route 1 South in the vicinity of Phu Tai Ammo Dump. In addition, a 6" base course of rock is being placed on the Depot Access Road and on Route 1 South in preparation for the asphalt paving of these roads.

(3) The following projects were continued from the previous quarter:

(a) On 20 December 1966, "A" Company completed site preparation and installation of quarry and 75 ton per hour rock crusher located on Route 19, Qui Nhon. This facility subsequently was turned over to the 84th Engineer Battalion (Const). The project was started on 15 March 1966, but due to lack of parts for crusher, the installation was delayed. 18,040 US manhours, 5,550 Vietnamese manhours and 11,836 equipment hours were expended on the 75 ton per hour site. Crusher contained primary and secondary jaws and rolls, conveyor belts and two generator sets. Cleared for the quarry was 285,600 square feet of land, plus construction of two 20' x 60' buildings for guard house and operations building. 150,000 square feet of access roads were constructed for the movement of two air compressors and three drilling sets to the quarry site.

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

(b) Self-help projects for cantonments for the 1/30th Artillery and the 14th Aviation Battalion located on Route 6B vicinity of Qui Nhon proceeded slowly and only a few buildings remain to be constructed for the units presently in the area. Advance parties for two new units, the 196th Aviation Company and 8/26th Target Acquisition Battery arrived in January 1967. Their self-help construction will continue on the remainder of the cantonment originally scheduled under the initial program.

(c) The Hasty Helipad #2, located at the 14th Aviation Battalion was completed except for a final coating of double surfacing treatment. Plans, construction estimate, and schedule were made for a twenty-four helipad extension, an eight pad extension to each of the three helipads already in use. However, this project was not started due to the priority assignment of a new 16 helipad helipad to be constructed for CH 47 Chinook helicopters. This project, assigned on 15 January was required to be completed for a Chinook company scheduled to arrive on 15 February 1967. Presently under construction by "C" Company, the project will cover a 12 acre area and will include sixteen 50' x 100' helipads plus taxiway and 300' x 330' maintenance area, all of which will be double surfaced asphalt surfaces. A double shift at this site to effect complete utilization of equipment, was incorporated after the monsoon rains. This program to date has been extremely effective, and is expected to permit the utilization of the helipad on the required Beneficial Occupancy Date.

(4) Summary of Combat Support missions:

Battalion combat support missions terminated during the quarter were Operations Thayer and Tiger Hound. Operation MENG HO 8, in support of ROK Tiger Division in opening Route 1 South, was initiated and completed during this quarter.

(a) Operation Thayer started in September 1966, continued in support of the 1st Cavalry Division operating out of Hammond Airfield. Working with the 8th Engineer Battalion, "B" Company continued to upgrade and maintain Route 1 from Hammond Airfield to Bong Son. Security was provided by elements of 1/9th Cav. Viet Cong activity was heavy during the period, and required daily clearing of the road for mines. A total of 150 AP and AV mines were destroyed in place. The Viet Cong also employed demolitions on by-passes necessitating extensive effort in some areas. Work completed included 11 by-passes constructed and/or improved with wooden headwalls and two 15' steel stringer timber decked bridges.

In conjunction with advanced elements during Operation Thayer, the Headquarters Section, 2nd and 3rd Platoon of "C" Company on 19 November 1966 moved to English Airfield in Bong Son with the mission to surface the airfield with M8A1 matting to provide an all weather landing capability. Scope of the project was to place matting on the runway 60' wide by 3,600' long with 150' square turn arounds at each end. Commencing on 20 November, the first and second

Incl 1

CONFIDENTIAL

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCX CSFOR-65), for Quarterly 8
Period Ending 31 January 1967

platoon, starting at the welded panels in the center of the airfield, completed the entire runway for air traffic, unloading and placing all the matting in six days. At this time, due to wet conditions prevailing in the area, original plans to cover the taxiway and parking apron with T-17 membrane changed to utilize M3A1 matting. In order to let the placing of the matting continue on schedule, the first and third platoon of "B" Company were moved to Bong Son as reinforcements to complete the anchorage system of the runway. Due to record fall of over 30" of rain during the month from November to December, and the problem of matting resupply due to impassable roads, it was not until 4 December that "B" Company was able to finish the anchorage system and return to their company headquarters at Landing Zone Crystal. On 20 December, "C" Company completed both the apron and taxiway in time for use by the advance parties of the 1st Cavalry Division. A further commitment to penneprime the airfield shoulders required that the third platoon of "C" Company remain at English Airfield after the headquarters and second platoon returned to the battalion base camp in Qui Nhon on 21 December.

With a change of operational areas on 5 December and transfer of the mission to repair Route 1 North from Qui Nhon to Bong Son, "B" Company returned to Qui Nhon completing their participation in Operation Thayer.

The third platoon, "C" Company continued to support Operation Thayer opening Route 1 South of Bong Son and in support of the 22d ARVN Division in opening Route 1 from Bong Son to Tam Quan until 13 January 1967. At that time the platoon was put under operational control of the 35th Engineer Battalion and assigned the mission to open 10 miles of road going into "Happy Valley" located north of An Khe Pass to Vinh Tham Special Forces Camp. On this mission general improvement of drainage and grading was required for half the length of the road. One 36" diameter 32' culvert was placed and river run rock was spread to open two previously impassable areas. After the road was open, additional repairs were made to the road surface. The project required 1,540 man hours, 425 equipment hours, and 470 cubic yards of fill. On 19 January the mission was completed and the third platoon closed at battalion headquarters. Except for the present continuing security requirement to patrol the Bong Son railroad bridge with boats, motors and operators supplied by the 554th Engineer Company (FB), the battalion's commitment to Operation Thayer during this quarter ceased.

(b) The 3d Platoon of "C" Company participated in Operation Tiger Hound at Kham Duc Special Forces Camp during the period from 14 September to 19 December 1966. The mission called for the construction for United States Air Forces Personnel of a shower and latrine facility, five aircraft revetments, the extension and joining of two camp headquarters building and a reinforced concrete communications bunker. Considerable delay was encountered due to the lack of supply and equipment which was unavailable at Kham Duc due to the inability of the Seventh Air Force to schedule flights. This was caused by the Air Force change in priority of the Kham Duc mission.

CONFIDENTIAL

CONFIDENTIAL

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SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), 31 January 1967
Period Ending 31 January 1967

9 (c) "A" Company on 17 November was assigned the mission to correct the drainage of Van Canh Airfield to prevent further rain damage and repair existing tears in T-17 membrane on the airfield. The 1st platoon undertook the project and before returning on 24 December 1966, the unit surveyed, designed, and constructed 4,750 feet of all weather drainage system to protect the field from further damage. It also corrected 2,250 feet of eroded spots along the apron and the runway, plus constructed 3,175 feet of new drainage systems to divert water flow. Despite heavy rains of the monsoon season, complicating resupply and working conditions, the project was expediently accomplished.

(d) On 27 December, the battalion was given the mission to provide direct support to the ROK Tiger Division in opening Route 1 South from Qui Nhon to Song Cau. The concept of the operation was, in conjunction with previous operations Thayer and John Paul Jones, to open Route 1 from Bong Son and eventually from the I Corps Border to Cam Ranh Bay. The mission to open the last remaining stretch of road in this vital link was assigned to "A" Company. With elements of the ROK Tiger Division, the engineer mission was to open the road from the Cu Mong pass to Song Cau. Simultaneously, the 1st Brigade of the 101st Airborne Division was to secure the area from Tuy Hoa to Song Cau, as elements of the 39th Engineer Battalion pushed North on Route 1 to Song Cau.

From 27 December to 2 January, "A" Company made reconnaissance, equipment preparation and preliminary stockpiling of critical materials in anticipation of the operation. Moving South from the Cu Mong Pass on 2 January, "A" Company repaired deep cuts in 23 miles of road with "B" and "C" Companies hauling 1000 cubic yards of 3" minus rock from the crusher at the 45th Engineer Group Construction Support Complex. One corduroy by-pass and several PSP by-passes were constructed for heavy equipment, 150 feet of Eiffel bridging was rebuilt and redecked for use, plus roads were reconstructed to make landslide areas in the mountains passable. Bridging included construction of a 29'6" steel stringer bridge, replacing a destroyed 110' SS Bailey and building a 28'6" single span timber trestle bridge on existing abutments. At an existing site with an intermediate masonry pier, a 48'6" timber trestle bridge was constructed. With the assistance of the 509th Float Bridge platoon, three bailey bridges were assembled, one 70 foot DS and a 80 foot DS on existing abutments. In addition, a 190 foot DS bridge was constructed on existing abutments with four stone masonry intermediate supports...

The mission was accomplished on 20 January, prior to operation "Road Runner" scheduled 22 January. Operation "Road Runner" emphasized the strategic importance of opening Route 1 when a Reconnaissance Platoon of the 101st Airborne Division returned from Kontum down Route 19 to Qui Nhon, then proceeded down Route 1 through Song Cau to Phang Rang to accomplish the longest road drive to date in Viet Nam. With the mission successfully completed, "A" Company closed at the battalion command post on 24 January 1967.

CONFIDENTIAL

CONFIDENTIAL

EGD-3E-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

10

The 554th Engineer Company (FB) and the attached 509th Panel Bridge Platoon provided invaluable support to this battalion and other battalions in the 45th Engineer Group during this quarters. In support of Operation Thayer, the unit transported M4T6 dry spans and building materials, rations, and fuel to Bong Son. Additional hauling was required for Pleiku and An Kho. Presently, boats, outboard motors, and operators are supporting the 1st Cavalry Division in guarding the Bong Son Bridge. Their manpower and equipment proved invaluable at the beginning of the Logistical Depot Expansion project since at that time the majority of the battalion was on combat support. Presently, with a heavy battalion commitment on construction support, extensive support has been provided by the haul capabilities of 5 ton bridge and 5 ton dump trucks. This support capability has been used by the 45th Engineer Group to provide supply and large haul capabilities to the entire group.

c. Intelligence and Security.

During the reporting period the Reconnaissance Section has been employed in preparing detailed route reconnaissance reports of areas from Song Cau to I Corps border in anticipation of opening the local Vietnamese coast region to normal civilian traffic after years of Viet Cong control. Much of the intelligence provided from these reports were used in Operation Thayer and MUNG HO 8, and the remaining information is being utilized in designs and plans for restoration of all routes to scheduled traffic. General scope of these reports cover the following:

- (1) Deliberate road and bridge reconnaissance of Route QL 1 from Song Cau to Bong Son to include 121 bridges and 94 miles of road.
- (2) Deliberate road and bridge reconnaissance of Route QL 19 from Qui Nhon to An Kho to include 20 bridges and 42 miles of road.
- (3) Deliberate road, railroad, and bridge reconnaissance of Route LTL 6B and the National Railroad from Qui Nhon to south of Van Canh. This includes 21 miles of roads and railroads plus 17 bridges.

A second major reconnaissance effort of the reconnaissance section during this period was devoted to gathering all pertinent information of effects of the monsoon rains on construction projects, main and access routes. The effect of the 1966 monsoon season was such that total rainfall was not indicative of the damaging rains. Intensity and high runoff factor was the major cause of destruction. The period of 25-27 November was considered the worst of the rainy season causing the most destruction. The following is indicative of the problems encountered and can be expected during all future monsoon rains. Five bridges in or near the Engineer Area of Responsibility of the battalion were destroyed or damaged. Torrents of running water eroded away abutments and caused the structures to list badly or fall completely into the gap. These structures were an Eiffel bridge at BR 914180 *(replaced by Bailey bridge), a Bailey bridge

*Map Sheet: 6852, Series L701

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31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS:CSFOR-65), for Quarterly Period Ending 31 January 1967

at the entrance to the 14th Aviation Battalion area (replaced by a longer bailey) a bailey bridge at BR 886586 (extended to reach over the damaged abutment), an M4T6 dry span bridge at BR 970352 (replaced by a bailey bridge) and a concrete T-beam bridge at BR 915443. This last bridge was replaced by a 140' DD bailey bridge and later by a 160' DT bailey bridge when the abutments eroded further. The bridge at BR 979339 was in the process of being replaced by four (4) sections of large culvert by ARVN engineers. When the rains of 25-27 November hit, this repair was completely washed out, leaving a 72 foot gap which also had to be spanned by bailey bridging. At least 840 feet of equivalent DS bailey bridging were used to repair storm damage to vital LOCs. This heavy use of tactical bridging taxed existing stocks greatly.

In addition to bridge damage, all but one of the expediently constructed culvert-type bypasses on Route QL 1 between Qui Nhon and Bong Son were washed out by raging waters flowing at a rate many times greater than that which the culverts could accommodate. The power of this moving water can best be appreciated by noting the fact that, at many locations, several thirty or forty foot sections of 60" culvert were displaced from their intended site, picked up, torn and bent, and carried several hundred yards downstream. Filled sandbags, used in headwalls construction, were found strewn around stream banks where the current had carried and deposited them.

During this three day period, 25-27 November 1966, when the monsoon was at its worst, standing water was evident at many locations. Most striking of these was the area around the intersection of Routes 1 and 19 where the entire surrounding countryside was inundated. The access road to Hq. 22d ARVN Division was under about two feet of water and Route QL 1, at a point about one mile south of the intersection, came within one or two inches of going under water; local national persons were using boats for transportation in this area. An overlay can be found in Appendix 3 which shows in detail these and other areas of flooding.

Battalion security system was revamped and improved by the revision of the battalion regulation on interior guard. Perimeter security facilities were improved by construction of two new guard bunkers at vehicle entrances and three guard posts were either renovated or completely rebuilt. The perimeter security fence received major repairs, with many feet of barbed wire and numerous pickets being placed. Additional belts of fencing were added where necessary.

Close coordination was maintained with those Valley "A" units that are subordinate to the 19th Engineer Battalion for physical security planning and alert notification. No incidents that threatened the physical security of any Valley "A" unit occurred during the reporting period.

With the commitment of ROK forces on MANG HO 8, all ROK security forces have been withdrawn and valley defense is currently being reorganized among occupying units. This has required extensive coordination with neighboring units in complying the best overall defense plan.

CONFIDENTIAL

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

d. Logistics:

12

Despite heavy rains limiting resupply routes and demands of material for immediate use on combat support missions, battalion S-4 functioned smoothly and efficiently. At no time during the reporting period was the entire battalion located in base camp, thus planning and coordination of construction material and supplies was done at a distance, necessitating long range planning and resupply. This supply was made possible throughout the reporting period by use of forecasts and construction schedules. Were it not for these schedules and the utilization of various keys to materials forecasting, mission assignment, duration, availability of on sight materials, resupply would have been greatly impaired.

Monsoon effects on the water point was negligible due to preparations and prior planning in advance of increased rain. Water rise at source was anticipated and movement of equipment was accomplished on time and successfully. Construction of a water tower to hold two rubber water tanks greatly enhanced the speed of water delivery. Tank is located so that a truck can drive on either side of tower and use gravity feed to fill water tanks.

Section 2, Part I, Observations (Lessons Learned)

1. Personnel

(None)

2. Operations

(Placing M8A1 Expedient Matting)

ITEM: In placing M8A1 matting, problem occurs in locking of successive panels and rows of matting.

DISCUSSION: When placing M8A1 matting as an expedient surface on an airfield, problem arose in that successive pieces of matting would not fit together and lock. This problem occurred after laying 25 to 30 rows of matting. Cause of this deficiency was discovered to exist because of tolerance between locking lugs and locking lug holes. After joining two pieces of matting the space between the lug and the side of the hole permitted the matting panels to shift approximately 1/16 inch in either direction. Due to the crown of the runway, this slack was taken up to the outside on each side of the runway centerline. As successive rows of panels were added, this slack caused an increasing gap to occur between individual panels, until the space between panels was so great that the next panel overlapping the preceding two would not fit or lock. (See schematic diagram, Appendix 1). As this occurred, no more matting could be placed unless it was locked by welding.

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report - Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

13 OBSERVATION: The spreading inherent in placing matting must be corrected while placing each panel. After a panel is dropped in place, and locked, each piece must be driven toward the centerline of the field. Approximately 2 or 3 blows with a 5 pound hammer is sufficient to take up tolerance slack of locking lugs.

(Shifting of M8A1 Matting During Placement)

ITEM: In placing M8A1 Matting on airfield, matting tends to shift off established centerline.

DISCUSSION: After establishing airfield centerline and placing rows of panels down the airfield, matting tends to shift off to either one side or the other of the runway centerline. Left uncorrected, this deviation was discovered to be as much as 3 inches per 100 feet of runway.

OBSERVATION: A survey team set up stakes on both sides of the proposed runway, at 50 foot intervals, approximately 6 inches wider than the matting. String was then tied between stakes. As the matting runway proceeded, a close surveillance was kept for any sign of matting shift. Any shift of $\frac{1}{2}$ to 1 inch was corrected immediately by stretching the matting on the side toward which the matting had shifted. Stretching was accomplished by hooking a chain to the matting at a point a few feet from the edge of the runway and pulling the chain with a $\frac{3}{4}$ ton truck. Two or three quick starts would stretch the matting a sufficient amount to square the matting back on to a straight line. Following this procedure, approximately 1200 feet of runway was placed without any offset in the matting.

(Procedure for Connecting ends of M8A1 Matting)

ITEM: Driving end-connecting pins in M8A1 matting.

DISCUSSION: End-connecting pins in M8A1 panels presented problems in that difficulties were encountered for the pinning crews in keeping pace with the placing crews. The solution to the problem evolved upon finding the best tools, methods, and procedures for driving end-connecting pins.

OBSERVATION: (1) The best power equipment for pin driving was found to be a clay spade with a squared-off chisel attachment. One air compressor with two attachments allowed a small pinning crew to easily keep up with the placing crew.

(2) A 5 foot bar was the best hand tool discovered for driving the first three connecting pins. This was done by sliding the bar along the groove in the panel and hitting the pin into it's recess. The fourth end connecting pin had a locking lug pin obstructing the panel groove, thus preventing efficient use of the 5 foot bar. The best hand tool for the fourth end-connecting pin was the mattock. The pointed end of the mattock could be swung over the locking lug pin and effectively drive the fourth end-connecting pin into position. The mattock was also the best hand tool for bending the tabs down

CONFIDENTIAL

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AGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

14

over the end connecting pins.

(3) In placing matting, it was found most advantageous to keep the pins all driven up to the last three rows on the runway. This procedure kept the matting tight, while the hammering of pins was far enough back from the rows being placed that it did not move recently placed steel.

(Hand Tool Breakage While Placing M8A1 Matting)

ITEM: Breakage of hand tool handles while placing M8A1 matting.

DISCUSSION: While placing M8A1 matting, extensive use was made of all pioneer hand tools, to include 3 and 5 pound hammers, pick-axes, and mattock. As a result, breakage of all wooden handles was very high.

OBSERVATION: When planning for any job in placing M8A1 matting, extra pioneer tool handles should be ordered.

(Safety Hazards in Placing M8A1 Matting)

ITEM: Injury as a result of use of sledge hammers in placing M8A1 matting.

DISCUSSION: Extensive requirement for sledge hammer utilization resulted in injuries received from three and five pound hammers.

OBSERVATION: Danger in placing matting arises because panels are driven laterally by a 5 pound hammer with golf-like swing. Troops should be cautioned in dangers of standing in the upward travel arc of a hammer swing in cases where hammer misses or deflects from its mark. The condition of all handles of tools must be closely watched in order to prevent danger from broken handles and loose hammer heads.

(Placing and Recovery Rates of M8A1 Matting)

ITEM: Placing and subsequent pickup and replacement rates of installing M8A1 matting.

DISCUSSION: Placing rates of M8A1 was found to be considerably less than the 240 square feet per manhour rate quoted in TM 5-337.

OBSERVATION: Calculated rate of placing M8A1 matting was 70 square feet per manhour. Rate for the pickup and subsequent replacement of matting in a nearby location was found to be 22 square feet per man hour.

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

(Anchoring M8A1 Expedient Airfield Runway)

15
ITEM: Anchoring M8A1 expedient airfield runway.

DISCUSSION: Matting placed on laterite surface required anchors to prevent movement of matting, particularly during wet season. Considerable effort is necessary to accomplish this mission, and planning should be scheduled accordingly. The spacing of anchorages depends upon amount the matting will by its own weight hold itself in position. A sandy field will require less than a hard surface on which the matting will slide.

OBSERVATION: (1) Matting was anchored by extending half panels out onto the shoulders of the runway. These panels were left out while the matting was being placed so that anchorage panels would not slow down placing of matting. An anchorage crew was then required to follow the matting crew, dig holes, bond and bury the panel extensions. (See Appendix II).

(2) Holes were dug at a 2:1 slope. The panel then is locked into the runway, and bent down into the hole. The panel can easily be bent by first placing a 4" x 4" timber under the panel at the edge of the hole. The rear dual tires of a 5 ton dump truck backed over the timber will bend and crease the panel. After removal of the timber, backing the truck duals over the panel again will firmly seat the panel in the hole.

(3) The bonding operation is critical in that no air space can be allowed under the panel for proper backfill of the hole. Backfill is done in three layers with the trucks tires providing compactive effort. All holes should be mounded, compacted with roller and graded to the slope of existing field.

(Recovery Procedure)

ITEM: Recovery of Ordnance Equipment

DISCUSSION: During monsoon season, mired wheeled vehicles were frequently recovered using improper techniques which resulted in damaged vehicles. A frequent occurrence was pulling wheeled vehicles by front bumpers which resulted in damage to the bumpers. Damage was a direct result of insufficient training in vehicle recovery at the user level, and improper tools and equipment available for recovery.

OBSERVATION: Prior to advent of next monsoon season, classes should be conducted in vehicle recovery by all units using TM 20-22 as a guide. Supplies of 1/2" and 5/8" cable and clamps, towbars, chain, and winch repair parts should be stock-piled or made available to all units prior to the monsoon rains.

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

16

(Roabilitating Eiffel Bridging)

ITEM: Sway Bracing For Eiffel Bridging

DISCUSSION: During recent combat support operations in opening a national route, utilization of full capacity of existing Eiffel bridges was hindered due to the lack of sway bracing on the bridge. Replacement parts for sway bracing were not available.

OBSERVATION: By using 1/2" wire rope with clamps and turnbuckles, satisfactory substitute was utilized with expedient efficiency.

(Field Storage of Class "A" Rations)

ITEM: Preservation of Class "A" Rations in the Field

DISCUSSION: While on combat support mission, daily resupply of Class "A" rations was not possible to a company size combat engineer unit and no means were available to store perishable rations while on a moving tactical mission.

OBSERVATION: A field refrigerator, 65 cubic feet was secured to a 2½ ton pole trailer with ¼" wire rope and turnbuckles. The refrigerator then being portable enabling the unit to take "A" rations wherever it moves.

(Clearing and Grubbing Operations)

ITEM: Clearing Operations Using Rome Plow

DISCUSSION: Rome plow was considered successful during dry weather, however during periods of heavy rain, the thick growths of underbrush became very wet, and tended to slide along the blade of the plow instead of being cut.

OBSERVATION: It should be anticipated that during periods of heavy rains, the efficiency of the Rome Plow in clearing thick underbrush will be significantly diminished.

(Recovery - Tracked Vehicles)

ITEM: Recovery of Mired Dozers

DISCUSSION: During monsoon rains dozers frequently became mired while operating in soft rice paddy areas.

OBSERVATION: One expedient method of recovery effectively used during the preceding monsoon was to chain logs to the tracks, thus increasing traction for recovery.

CONFIDENTIAL

CONFIDENTIAL

EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

3. Training and Organization

(Reconnaissance Team Vehicles)

17
ITEM: Vehicle Strength of S-2, TO&E 5-35E

DISCUSSION: This battalion is presently scheduled to change from TO&E 5-35D to TO&E 5-35E. This change incorporates a replacement of $\frac{1}{4}$ ton trucks with $\frac{3}{4}$ trucks. For the present situation encountered through experience in Viet Nam, the best vehicle for reconnaissance is a $\frac{1}{4}$ ton vehicle equipped with M-60 machine gun with appropriate mount.

OBSERVATION: That TO&E 5-35E be modified to keep $\frac{1}{4}$ ton reconnaissance vehicles with M-60 machine gun mounts authorized instead of the change to $\frac{3}{4}$ ton vehicles.

(TO&E Organization - Dispensary Lighting)

ITEM: Emergency Lighting for battalion dispensary

DISCUSSION: TO&E emergency lighting facilities of a 12 volt battery does not provide adequate illumination for care of emergency cases when main generator is not operational.

OBSERVATION: Battalion dispensary should be authorized a 1.5 KW generator to handle emergency situations and to operate field refrigerator. When a generator is not feasible, a 24 volt battery system is the minimum power requirement considered necessary to provide adequate illumination.

4. Intelligence

(Weather Effect on Water Purification Points)

ITEM: Rise of river water levels at water purification points.

DISCUSSION: During monsoon season, the river on which unit's water purification team is located, rose at times, 8 feet within a 30 minute time period.

OBSERVATION: Water purification equipment should be located in such a manner that relocation would be feasible on short notice. It is imperative that water level of source be kept under constant surveillance during the worst portion of the monsoon season. Access roads should further be constructed and maintained as all weather roads, especially in areas located near water sources which are susceptible to frequent flooding during the monsoon season.

CONFIDENTIAL

Incl 1

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

5. Logistics

18

(Supply of Tactical Bridging)

ITEM: Depot Storage of Tactical Bridging

DISCUSSION: On several occasions this unit has been called upon to draw tactical bridging from depot storage sites in the Qui Nhon area. Items required have included complete bridging and replacement parts for in place bridge repair. Problem arises in that although stock records reflect bridging sets, shortages and spare parts are not reflected on cards and cause considerable confusion when attempting to draw components. Bridging is further depot loaded, and considerable time is expended cutting ties and bolts to make the bridge ready for use. There is no maintenance of the bridging tools and components while stored in depot areas.

OBSERVATION: That a bridge park, established and maintained by the nearest bridge company, would eliminate delays and confusion, enabling the supporting bridge company to react rapidly and with maximum efficiency. Such a system would be similar to the system in Europe where tactical bridging is stored and maintained in a bridge park.

(Control of Hand Receipted Equipment)

ITEM: Authorization and Transfer of special construction equipment.

DISCUSSION: (1) Many combat engineer battalions in Viet Nam are providing extensive construction support and do not have necessary equipment for special construction projects. As a result, engineer construction equipment, such as asphalt distributors, steel wheel rollers, rock crushers, soil testing sets, pipe cutting machines, etc., are presently being laterally transferred and/or hand receipted among battalions and groups, as missions change and fluctuate. Problems are encountered when transfer of property to other engineer units is done before paperwork can be initiated. When follow-up paper work is presented to unit, the users do not desire to sign for equipment which they already have in their possession or will not sign because they say it was received in an unsatisfactory condition in the first place. Difficulties increase as projects are transferred and mission priorities fluctuate necessitating further transfers. Control of assigned equipment is extremely difficult when hand receipted to remote units and/or allied forces.

(2) An MFOE will not solve the equipment problem since the mission of each organization changes continuously and equipment no longer needed is turned into appropriate support units.

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EGD-BE-CO

SUBJECT: Operational Report-Lessons Learned (KCS CSFOR-65), for Quarters 1967
Period Ending 31 January 1967

19
OBSERVATION: A centralized engineer equipment pool could be established in the Qui Nhon area under the auspices of the area engineer for all special items of equipment such as rollers, asphalt distributors, and other items that would be required for special engineer jobs. Items could be hand receipted directly from this pool as needed for missions and returned upon completion. This would eliminate the necessity for the battalions attempting to control widespread equipment requirements and also provide a centralized point for maintenance and issue. Guidance for operational control of equipment could be provided through nearest engineer group. This concept is established in Europe to supplement engineer units lacking equipment needed for a special or single mission requirement.

6. Maintenance

(Monsoon Effect, Ordnance Equipment)

ITEM: Brake wear on Ordnance equipment.

DISCUSSION: During monsoon season ordnance equipment was required for combat and construction support on areas where soil conditions were such that vehicles operated in mud and water over the level of the axles and brake drums much of the time. This situation caused brake shoes to wear excessively, brake cylinders and brake return spring to rust and not function properly. Further, since repair parts for brake systems are either PLL or DX parts, a shortage existed in repair parts supply. Resulting maintenance problems of replacing damaged parts delayed or considerably slowed down the effort and/or response of the unit during this season.

OBSERVATION: (1) Wash facilities should be provided for all vehicles so that mud can be removed to provide for better surveillance of maintenance of the vehicle.

(2) An overage on PLL for brake systems and DX parts at higher support units should be considered in order that sufficient parts will be available during peak demand periods.

Section 2, Part II, Recommendations:

1. Personnel

Control of Venereal Disease: Due to lack of adequate control of the reservoir and source of venereal diseases in the area, the major communicable disease and preventive medicine problem for this unit's personnel is venereal disease. A lack of backing and enforcement of a VD control program by the local Vietnamese officials is evident in that no apparent treatment is available to an infected civilian woman who is serving as a reservoir to the venereal disease.

CONFIDENTIAL

CONFIDENTIAL

EGD-DE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

20

Reasons for this attitude can be related to conflict of interest inherent in the ownership of bars, etc., by some of the local government and local police officials. While this is a poor reflection on the nature and quality of the local Vietnamese government, the practical effect is that the entire VD control program for U.S. personnel is jeopardized by the failure to control the sources of the infection. In order to decrease the rate of infection within this area some positive arrangement through treatment of infected women and control of establishments where promiscuity flourishes must be incorporated and enforced by local Vietnamese officials.

A recommended feasible program which high level command could emphasize in attempting to overcome indigenous apathy might be a program whereby US personnel treat all women requesting assistance and make available to them documentary proof of treatment. Such documents will then become invaluable, financially speaking, to the local populace if US personnel were to patronize these women and avoid those who have no evidence of having received medical treatment. The program once it is operating effectively, will exemplify its own merits to the local Vietnamese population, and can be turned over to the Vietnamese government once qualified personnel are trained.

2. Operations

a. The combat support mission, Tiger Hound, was initially scheduled to start on 14 September and be completed on 1 November. Although the mission was carefully planned and executed efficiently, the project was not completed until 19 December, due to lack of materials. By the time airlift capabilities became available to transport the necessary materials, the monsoon season commenced and the weather prevented the landing of numerous supply flights attempting to reach Kham Duc. If the project had continued as scheduled, the mission would have been completed prior to the monsoon season, preventing the loss of 48 Engineer platoon days and many Air Force aircraft hours.

b. At English Airfield, considerable problems were encountered as a result of a pumping action of the matting on the airfield once air traffic commenced. A description of the airfield, problems encountered concerning pumping and recommended corrective procedure follow:

(1) General Description: English Airfield, prior to September 1966 was a 2,000 foot compacted laterite strip oriented in a north-south direction. This 2,000 foot compacted laterite strip had been in use for a considerable length of time and was well compacted with a crowned surface that provided good drainage. In September and October 1966 a 1,600 foot extension was added to the southern end of the airfield. The construction of the airfield extension consisted of a cut and fill operation. Fill for the first 800 feet of the addition, was cut from a hill that when cut down, completed the remaining 800 feet of the 1,600 foot runway EXTENSION. The fill operation of the initial 800 foot addition required 20 to 30 feet dept of fill, while the cut portion of the extension was brought to grade with approximately 3 feet of fill. Fill from the hill was a clayey laterite soil. The runway extension was compacted in generally dry weather and received very limited use before the monsoon rains.

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly Period Ending 31 January 1967

21 (2) Analysis and Probable Cause: Two days after "C" Company arrived at English Airfield the monsoon rains started and continued throughout the mission. Over 30 inches of rain fell during the period 20 November to 20 December. The area which experienced some settlement due to heavy rains was the newly constructed 1,600 southern section. In the areas which settled, the result was the loss of the crown and hence most of the runway drainage characteristics; water subsequently collected and supersaturated the surrounding soil. After placing the matting on the runway, these depressions were further aggravated by subsequent landing of heavy aircraft. These aircraft landings caused the matting to "pump". Within the first month of this field use, over forty multi-engine aircraft landed on this matting. When pumping problems were first noticed requests were made to have pilots land at the other, more stable end of the runway. However, due to prevailing winds from the northerly direction, all requests were denied. The evidence of the pumping damage done by these aircraft landings on this wet and already soft field appears in the regularity of the depressed areas down the centerline of the airfield. These areas are most pronounced in the area of touchdown and where the aircraft brake and reverse their engines. The depressions, on the far southern end of the airfield where the airfield is constructed on a cut section, are of a wide, shallow shape of 4 to 6 inches in depth, and 2 to 10 feet wide. The depressions near the center of the runway, where construction is over a deep fill, are more pronounced, with a depth of 4 to 8 inches and widths of 2 to 6 feet. These depressions on the field that are off the centerline tend to be shallow and less well defined. Generally they are 1 to 4 inches in depth and 4 to 12 feet wide.

The slope of the entire airfield is to the south, thus causing the southern or lower end to have more water pass over its surface and contribute to the softening of the clayey soil.

The conditions for a bearing capacity failure through the principle of pumping in a concrete pavement is the same as the pumping problem found on English Airfield. These conditions, of excessive ground water in the supersaturated soil, heavy loads of landing aircraft, and a clayey soil, were all prevalent at English Airfield, and resulted in pumping of the matting on the airfield. To preclude the repetition of this problem, it is recommended that first, fields with deep earthwork be allowed to "set" a season to settle. Secondly, for any field with a steep grade, in addition to a crown, the field should have a "French" type drainage system from the center of the field outward. Third, if the soil condition is such that there is a softening of the landing surface, the landing of heavy aircraft should be delayed until the surface can be brought to an adequate level of bearing capacity.

(3) Recommendation of expedient construction to prevent pumping action when time is a critical factor:

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EGD-BE-CO

31 January 1967

SUBJECT: Operational Report-Lessons Learned (RCS CSFOR-65), for Quarterly
Period Ending 31 January 1967

22

Assuming that construction and final shaping had been completed at a time such that the final surface of the field is dry and firmly compacted, the following two-step preparation prior to placing of the matting is recommended. First, the entire area to be matted is peneprimed at a rate of approximately .7 gals/square yard. The peneprime should be allowed to cure thoroughly until dry. Secondly, a two inch thick layer of sand is then placed on top of the peneprimed surface, moistened thoroughly (approximately 15-20% moisture content) by a water distributor, and compacted with a steel-wheeled roller. The matting would then be laid on top of the compacted sand in the normal manner. This preparation would prevent pumping by the construction of an impervious, quickly laid subbase cover, and would result in more adequate lateral drainage beneath the matting. In addition, the compacted sand would assist in the final anchored "set" of the matting. Although additional construction time is required to accomplish this preparation, this time is easily justified by the enhanced all weather capability afforded to the air-field and by the lessened maintenance requirement during extremely wet weather.

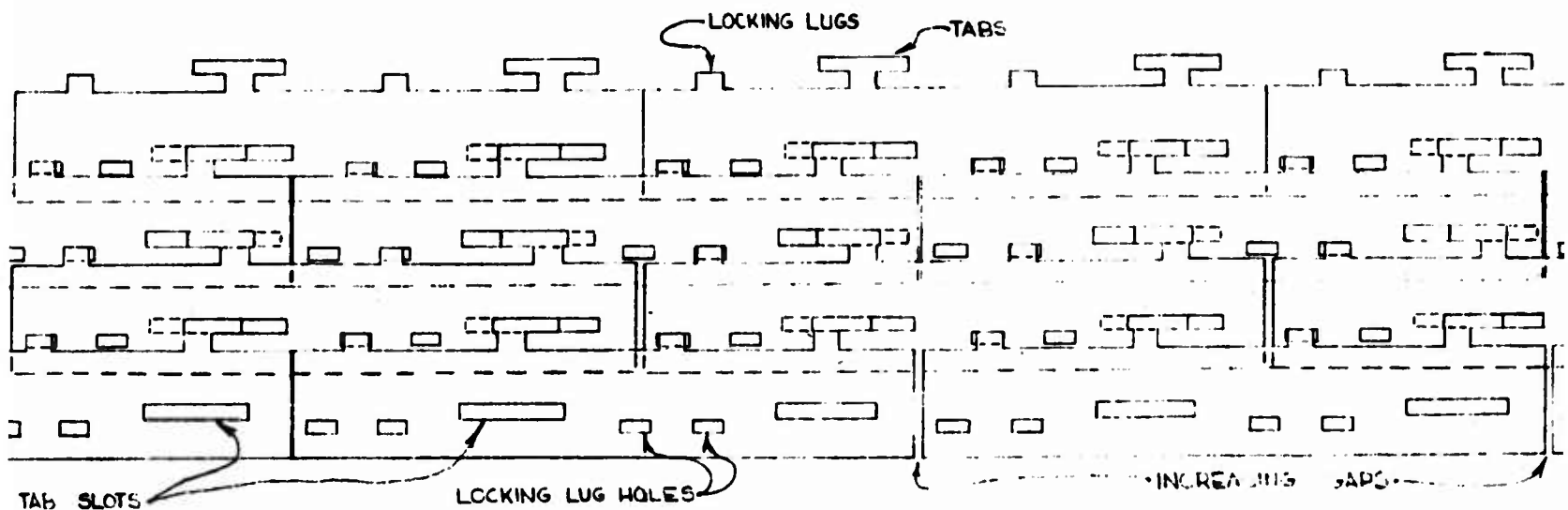
DISTRIBUTION:

3-45th Engr Gp
1-USARPAC (Air Mail)
3-USARV-DH
1-Dn File
5-18th Engr Bde, S-3


NOLAN C. RHODES
LTC, CE
Commanding

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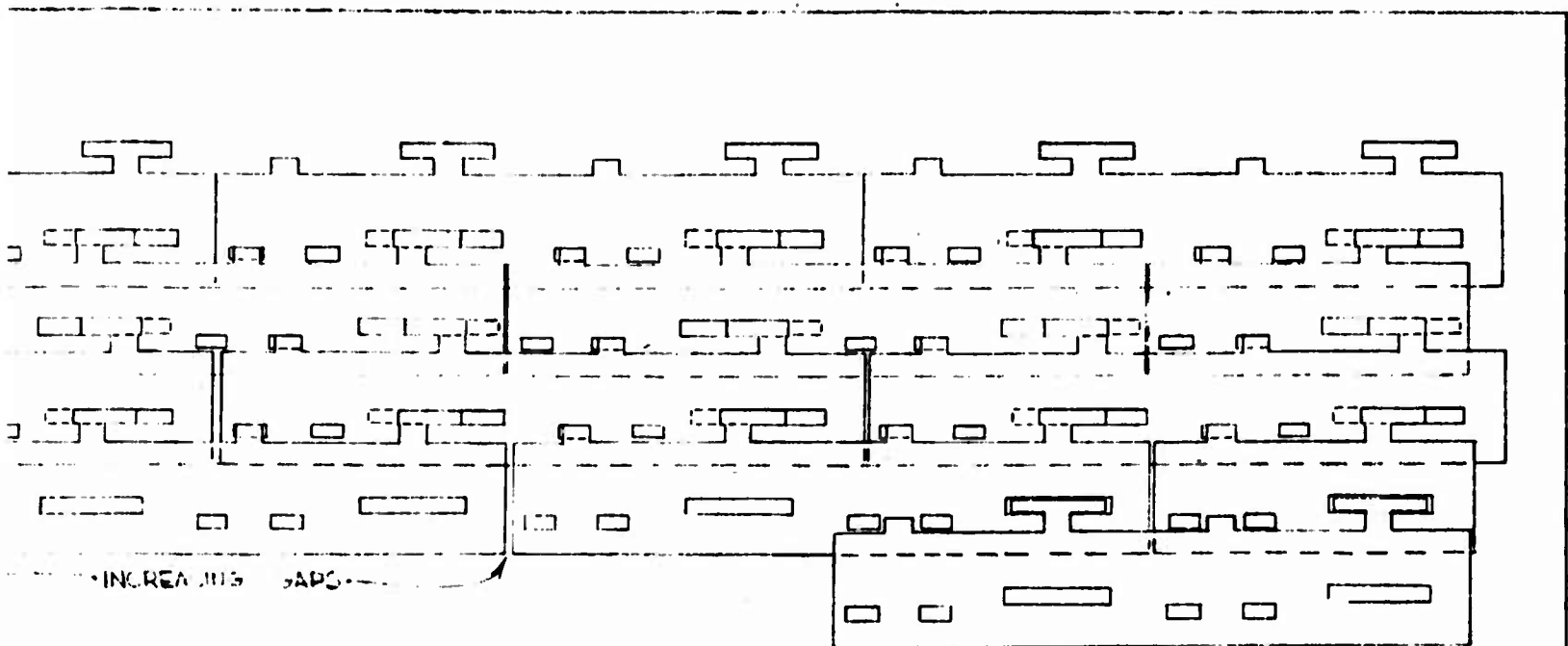
NOTES:

1. ASSEMBLY PROCEDURE:

- A. MATTING IS JOINED, BY INSERTING TABS INTO TAB SLOTS AT A 45° ANGLE
- B. WHILE HOLDING NEW PIECE OF MATTING AT 45° ANGLE, PANEL IS THEN SLID EITHER TO LEFT OR RIGHT UNTIL LOCK LUG AND HOLE ARE IN ALIGNMENT
- C. MATTING IS THEN ROTATED DOWN INTO LOCKED POSITION

DIRECT





TAB SLOTS
 15° ANGLE, PANEL
 IL LOCK LUG AND
 KED POSITION

DIRECTION of LAYING
 ↓ ↓ ↓ ↓ ↓ ↓

Sheet 1
 APPENDIX 1

19th ENGINEER BATTALION (C)(A)	
APO SAN FRANCISCO 96235	
DATE: 9 FEBRUARY 67	SCHEMATIC DRAWING of M8A1 MATTING
DRAWN BY: KUENTZLER	

2

25

ANCHORAGE of M8A1 MATTING

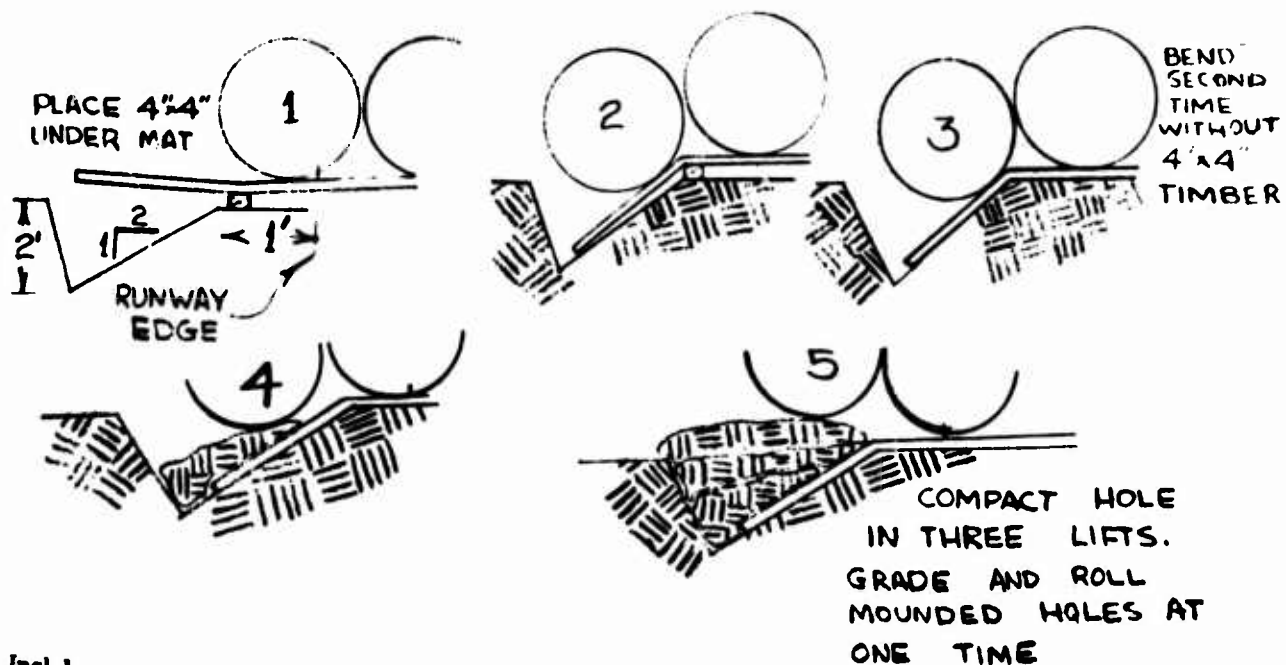
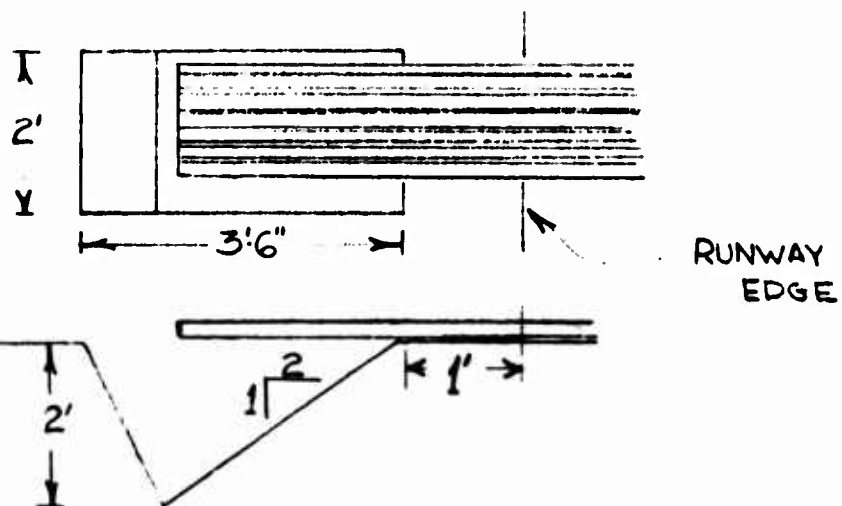


Fig 1

APPENDIX 2

MATC DRY SPAN, DAMAGED
BY ABUTMENT FAILURE,
REPLACED BY 70' D/S BAILEY BRIDGE

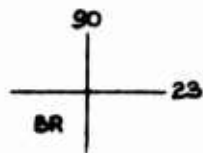
CULVERT SYSTEM WASHED
OUT, REPLACED BY 80' D/S

27

WATER LEVEL
WITHIN 1 OR 2 INCHES
OF ROADWAY SURFACE

LOW
AREAS
FLOOD

BAILEY BRIDGE
DAMAGED, REQUIRED
EXTENDING OVER
WIDENED GAP



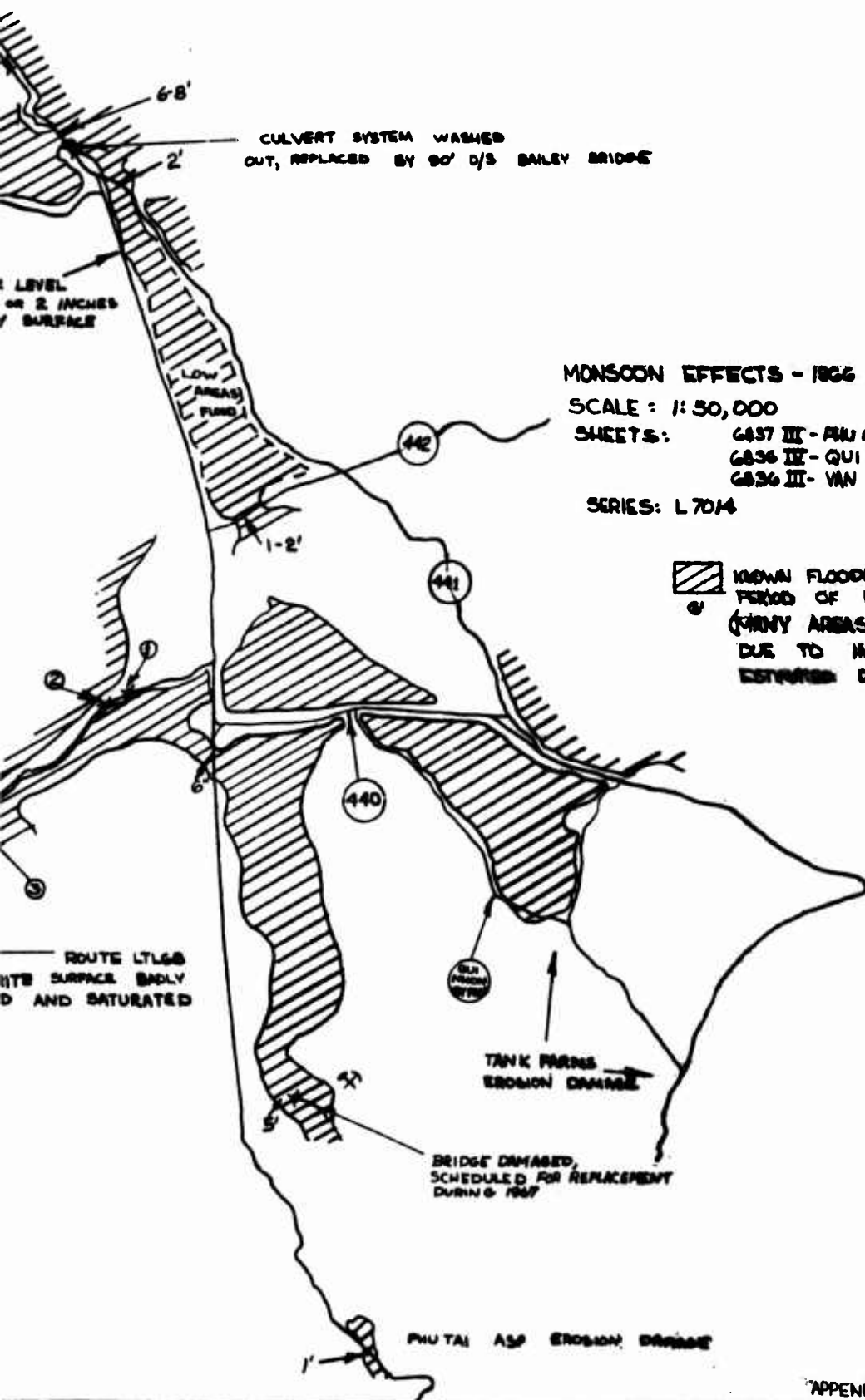
NOTE: BY-PASSES AT BRIDGES
1-6 EITHER UNDERWATER,
OR AT WATER LEVEL

ROUTE LT68
LATERITE SURFACE BADLY
RUTTED AND SATURATED

EIFFEL BRIDGE WASHED
OUT BY ABUTMENT FAILURE
REPLACED BY 120' T/S
BAILEY BRIDGE

BRIDGE
SCHED
DOWN

PHU TAI



CULVERT SYSTEM WASHED
OUT, REPLACED BY 80' D/S BAILEY BRIDGE

LEVEL
OR 2 INCHES
SURFACE


LOW
AREAS)
FLUOR

MONSOON EFFECTS - 1966

SCALE : 1: 50,000

SHEETS: 6437 III - PHU MY
6436 IV - QUI NHON
6436 III - VAN CANH

SERIES: L 7014

 KNOWN FLOODED AREAS DURING PERIOD OF HEAVIEST RAIN (23-27 NOV-66)
(MANY AREAS COULD NOT BE CHECKED DUE TO UNACCESSIBILITY)
ESTIMATED DEPTH SHOWN AS ABOVE

ROUTE 17166
WHITE SURFACE BADLY
D AND SATURATED

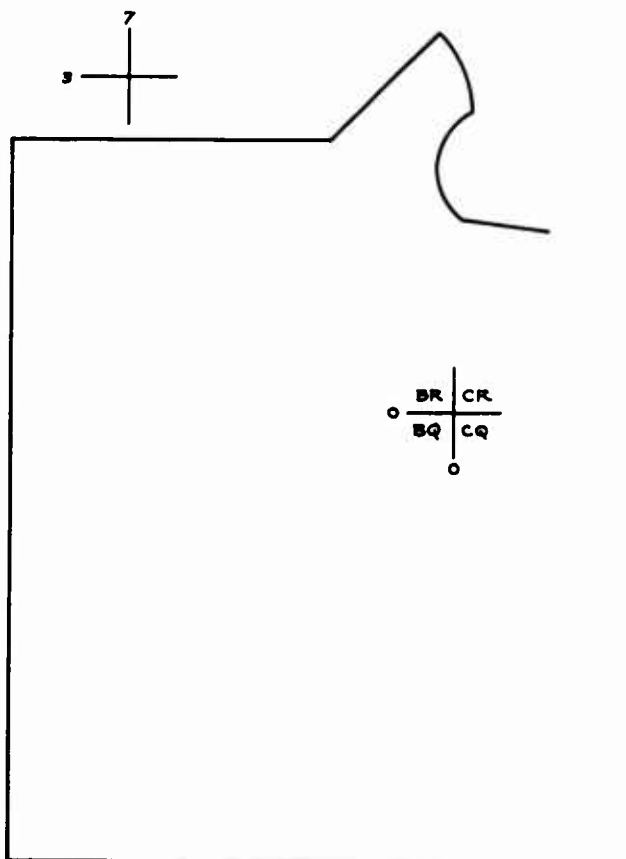
TANK FARMS EROSION DAMAGE

BRIDGE DAMAGED,
SCHEDULED FOR REPLACEMENT
DURING 1967

PHU TAI ASP EROSION DAMAGE

APPENDIX 3

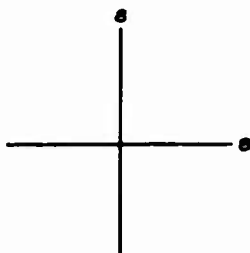
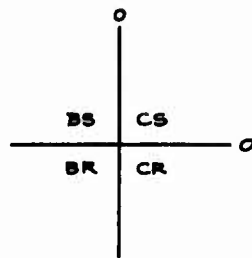
19th ENGINEER BATTALION (C)(A)		
APO SAN FRANCISCO 96230		
DATE 15 FEB 67	MONSOON EFFECTS 1966	
DRAWN BY: MCINTYRE		
CHECKED BY:		
SCALE: 1:50,000		WORKSHEET 17014



1: 250,000
SHEET NO. ND-49
SERIES 1501
DEC 1965

ENGINEER AREA OF RESPONSIBILITY
AFTER 27 NOV.
19th ENGINEER BATTALION
APPENDIX 4

31



1: 250,000
SHEET NO. ND-49 & ND49-5
SERIES 1501
DEC 1965

ENGINEER AREA OF RESPONSIBILITY
AFTER 27 NOV.
19th ENGINEER BATTALION
APPENDIX 5